65785

Impact-melt with Pink Spinel Troctolite clast

5.16 grams

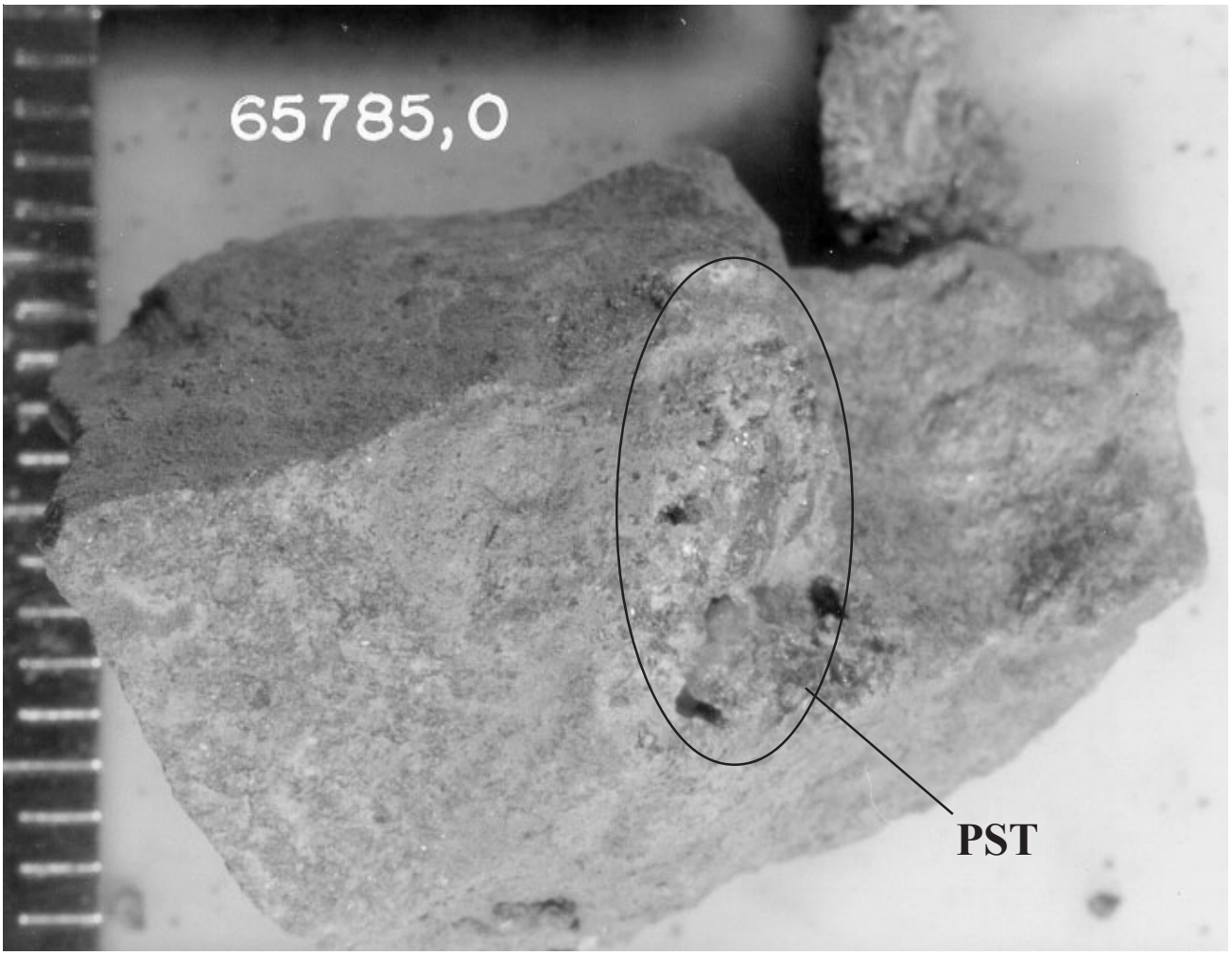

Figure 1: Photo of rake sample 65785 showing clast of pink spinel troctolite (PST) imbedded in recrystallized impact-melt. Scale in mm. NASA S72-48821.

Introduction

This small rake sample contains a coarse-grained pink spinel troctolite clast in a crystalline feldspathic impact melt rock (figure 1). The impact melt has been dated at 3.97 b.y.

Petrography

Dowty et al. (1974b) describe the pink spinel troctolite clast (figure 2). It is modally 65% plagioclase (An_{98}), 30% olivine (Fo_{85}) and 5% Mg-Al spinel. The pjnk spinel occurs as one large crystal (1 mm). Irregular plagioclase grains (0.1 – 1 mm) are surrounded by one large olivine grain. Minor phases are pyroxene, ilmenite, armalcolite, rutile, metal, troilite, whitlockite, farringtonite and K-feldspar (Warner et al. 1976).

Warner et al. (1976) describe the crystalline impact-melt rock that surrounds the clast. In it the plagioclase (An_{95}) occurs predominantly as laths about 0.2 mm long ophitically within olivine (Fo_{79}) and minor pyroxene grains. The fine-grained portion also has trace spinel, chromite, armalcolite, whitlockite, apatite, zirkelite and schreibersite as minor phases.

Keil et al. (1975) suggested that the melt-rock portion of 65785 may be a mixture of the troctolite lithology

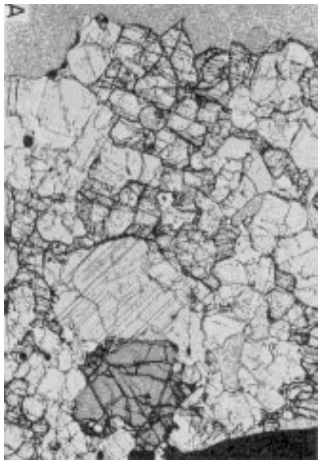

Figure 2: Thin section photomicrograph of pink spinel troctolite clast in 65785 (Dowty et al. 1974). Large spinel grain at bottom. Width of field about 2 mm.

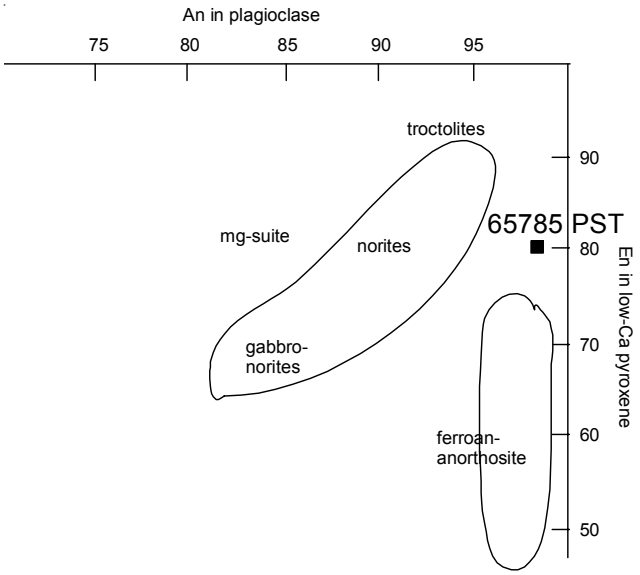

Figure 3: Plagioclase and pyroxene composition diagram for 65785.

with KREEP. Ryder and Norman (1980) summarize the results.

Mineralogy

Olivine: The olivine occurs as a large grain surrounding and including the other phases in the thin section of the pink spinel troctolite clast. It is slightly more mafic (Fo_{85}) than the olivine found in the surrounding matrix (Fo_{80}).

Farringtonite: Dowty et al. (1974b) and Warner et al. (1976) reported a rare phosphate ($Mg_3(PO_4)_2$) in the pink spinel troctolite clast.

Pyroxene: The pyroxene in 65785 is mafic in composition (figures 4 and 5).

Plagioclase: Plagioclase is An95-98.

Mg-Al Spinel: The large pink spinel grain in 65785 is zoned in Cr content (2.6 to 12.6%), increasing outward from the center (Dowty et al. 1974b).

Armalcolite: Dowty et al. (1974) determined the composition of armalcolite grains and reported on unpublished Pb-Pb age dating by ion microprobe analysis.

Metallic iron: Dowty et al. (1974b) found Ni = 2-25%, Co = 0.5-1.5%

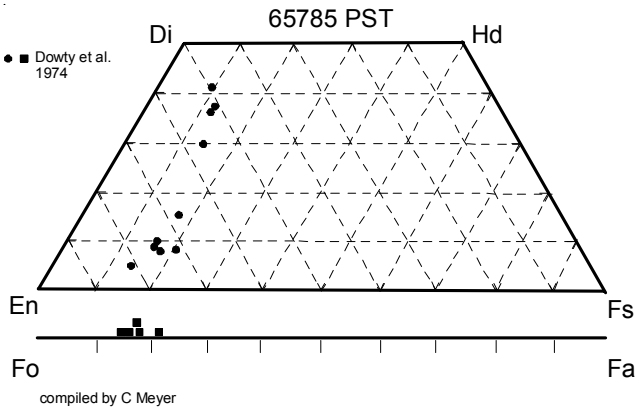

Figure 4: Pyroxene and olivine composition of troctolite clast (PST) in 65785 (from Dowty et al. 1974).

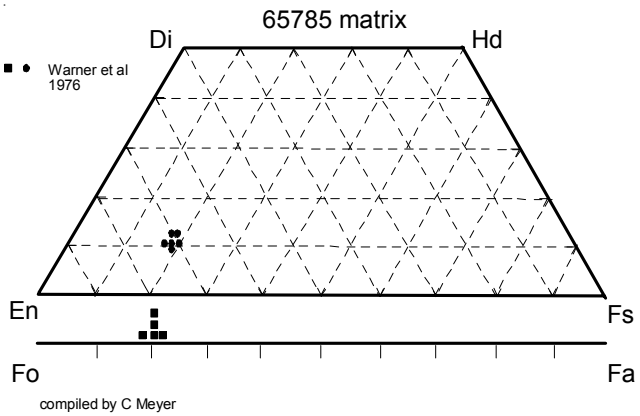

Figure 5: Pyroxene and olivine composition of melt-rock portion of 65785 (Warner et al. 1976).

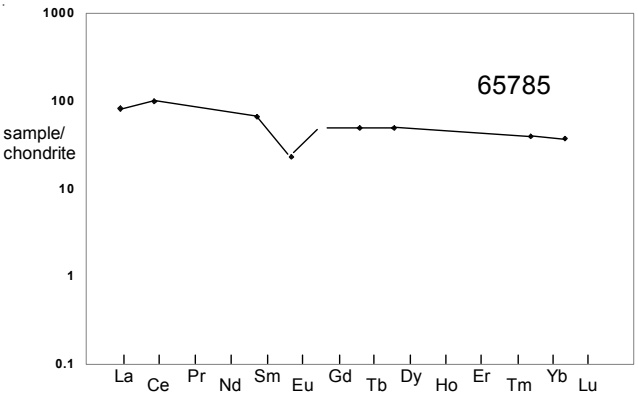

Figure 6: Composition of matrix portion of 65785 (Murali et al. 1977).

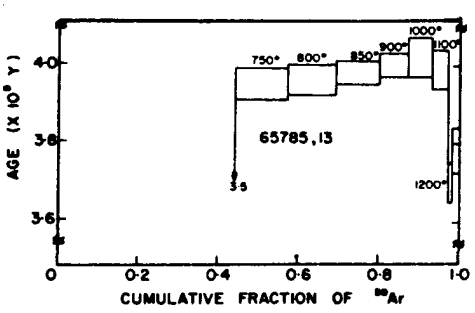

Figure 7: Argon release pattern for 65785 (Schaeffer and Schaeffer 1977).

Chemistry

The pink spinel troctolite composition was determined by broad beam electron probe analysis (Warner et al. 1976). Murali et al. (1977) reported the trace element analysis of the surrounding impact-melt (table 1, figure 6).

Radiogenic age dating

Schaeffer and Schaeffer (1977) determined the Ar/Ar plateau age of the feldspathic matrix of 65785 (figure 7). Dowty et al. (1974) reported ion probe Pb-Pb age data by Anderson and Hinthorne for three armalcolite grains in the troctolite clast.

Cosmogenic isotopes and exposure ages

Eldridge et al. (1974) found the cosmic ray induced activity for ^{22}Na = 45 dpm/kg. and ^{26}Al = 59 dpm/kg. Schaeffer and Schaeffer (1977) determined a cosmic ray exposure age of 271 m.y.

Summary of Age Data for 65785

	Pb/Pb	Ar/Ar	
Schaeffer and Schaeffer 1977			3.97 ± 0.02 b.y.
Anderson and Hinthorne	4.0	in Dowty et al. 1974	

Note: old decay constant for K.

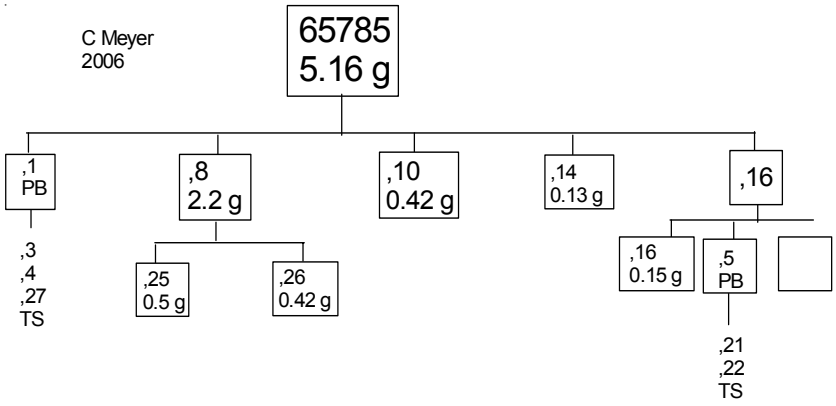

Table 1. Chemical composition of 65785.

	bulk		glass		feld clast		PST clast		
reference	Eldridge 75		Murali 77		Warner 76		Warner 76		Ehmann 75
weight	5 g		130 mg				Dowty 74		
SiO2 %					45.7	(b)	41.1	(b)	mentioned
TiO2			0.7	(a)	0.62	(b)	0.07	(b)	in Ryder
Al2O3			24.5	(a)	22.4	(b)	29.9	(b)	and Norman
FeO			7	(a)	5.2	(b)	3.7	(b)	1980
MnO			0.085	(a)	0.08	(b)	0.03	(b)	
MgO			12.7	(a)	10.4	(b)	9.6	(b)	
CaO			13.6	(a)	12.3	(b)	14.8	(b)	
Na2O			0.53	(a)	0.7	(b)	0.29	(b)	
K2O	0.22	(c)	0.26	(a)	0.51	(b)	0.04	(b)	
P2O5					0.2	(b)	0.04	(b)	
S %									
sum									
Sc ppm			9.9	(a)					
V			44	(a)					
Cr			1130	(a)					
Co			22	(a)					
Ni			302	(a)					
Cu									
Zn									
Ga									
Ge ppb									
As									
Se									
Rb									
Sr									
Y									
Zr			271	(a)					
Nb									
Mo									
Ru									
Rh									
Pd ppb									
Ag ppb									
Cd ppb									
In ppb									
Sn ppb									
Sb ppb									
Te ppb									
Cs ppm									
Ba			190	(a)					
La			19.2	(a)					
Ce			60	(a)					
Pr									
Nd									
Sm			9.8	(a)					
Eu			1.3	(a)					
Gd									
Tb			1.8	(a)					
Dy			12	(a)					
Ho									
Er									
Tm									
Yb			6.4	(a)					
Lu			0.91	(a)					
Hf			7	(a)					
Ta			0.82	(a)					
W ppb									
Re ppb									
Os ppb									
Ir ppb			7	(a)					
Pt ppb									
Au ppb			14	(a)					
Th ppm	3.03	(c)	2.4	(a)					
U ppm	0.97	(c)							

technique: (a) INAA, (b) broad beam elec. Probe, (c) radiation counting